After seeing the burndown assignment in the Capstone project, it has become evident to the course staff that the burndown video might be missing, or does not properly highlight, some key information for creating a burndown chart. Here is a step-by-step guide to assist you in creating a burndown chart. Let's start by reviewing some key information from the Release Burndown lesson.

The first thing to consider, is that the sprints in a release burndown chart represent the *beginning* of that sprint. That means that the bar (or point) on the chart for Sprint 1 represents the state of the project at the beginning of Sprint 1 (i.e. before the project has started). Therefore, the bar (or point) for Sprint 1 shows the total amount of story points that need to be completed at the beginning of the project. This is also referred to as the **total effort**.

Let's look at a simple example here. In the following chart, Sprint 1 has 100 story points of total effort. This means that at the beginning of the project, there are 100 story points to complete.
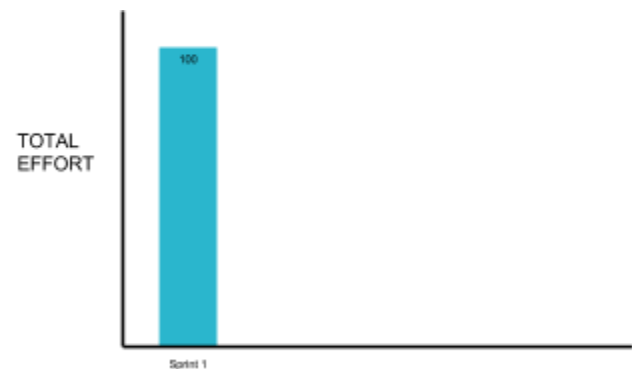

Simple enough! Let's now add another sprint. The Sprint 2 bar demonstrates the state of the project at the beginning of Sprint 2, therefore it shows what occurred in Sprint 1. Let's say that the development team completed 20 story points during Sprint 1. This is what that would look like on our burndown.
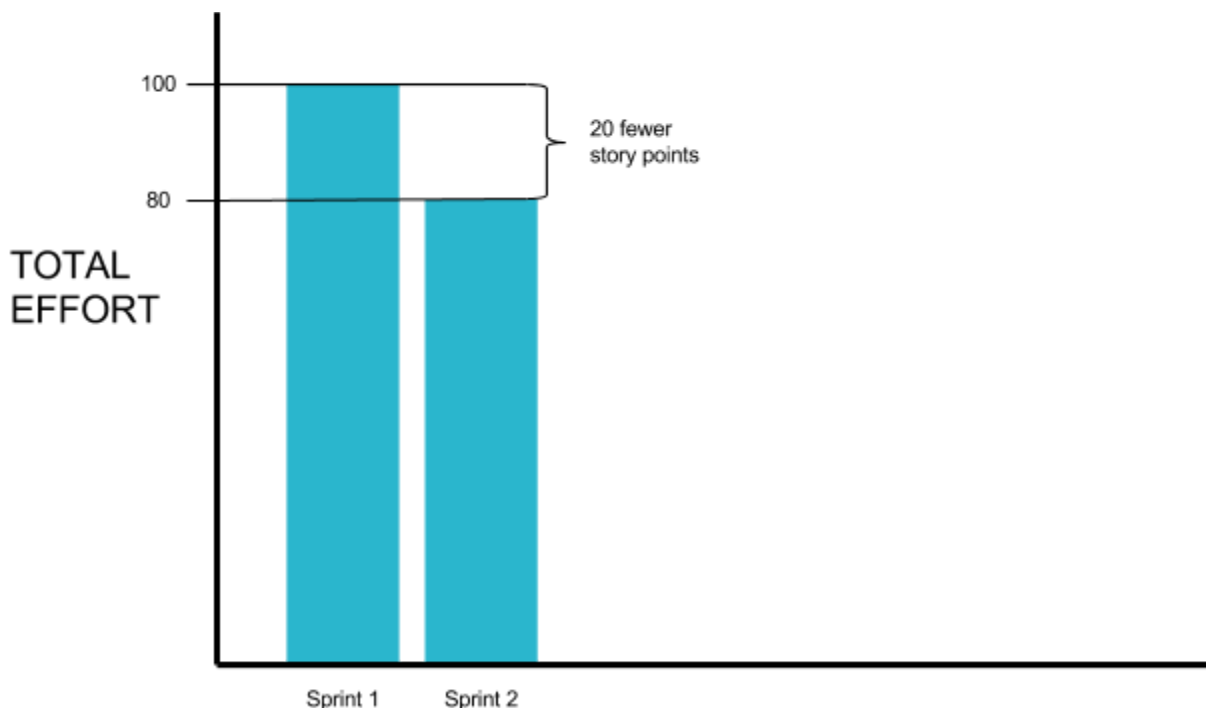
Now you can see that there are 20 fewer story points at the beginning of Sprint 2 than at the beginning of Sprint 1. But what caused this change in story points? We know (since I told you earlier) that the development team completed 20 story points, but this change in story points could also mean that 20 story points of work was deleted. To make this clear, we want to add the work completed on top of the bar to demonstrate that the work has been completed, and not removed. This will now turn the burndown chart into a **work remaining vs. work completed burndown chart**, and it will look like this:
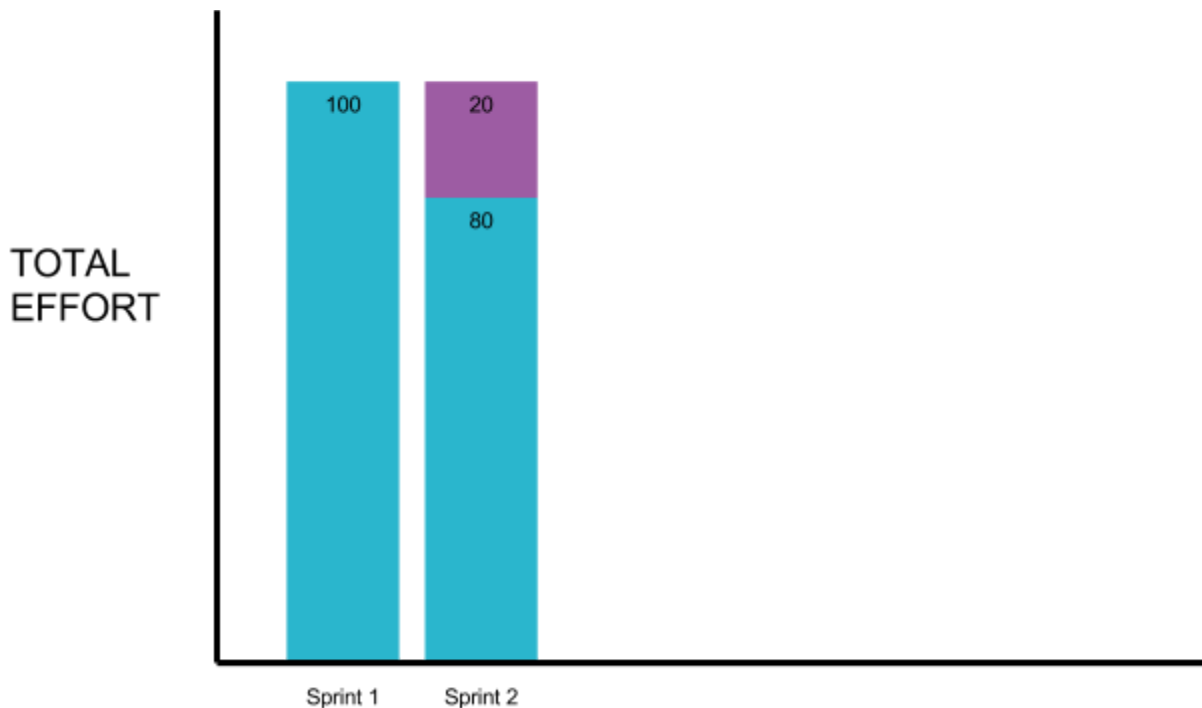
Now, let's add another sprint. Let's say that the team completed 15 story points in Sprint 2. The important thing to note here is that the work completed (i.e. the purple on our graph) represents the ***total work completed in the project***, not just the work that was completed in the last sprint. Let me reiterate that, this is the sum of all work done so far in all of the sprints. This will be very important when we start talking about how to demonstrate a change in story points. Your burndown chart now looks like this first chart, and not like the second chart.
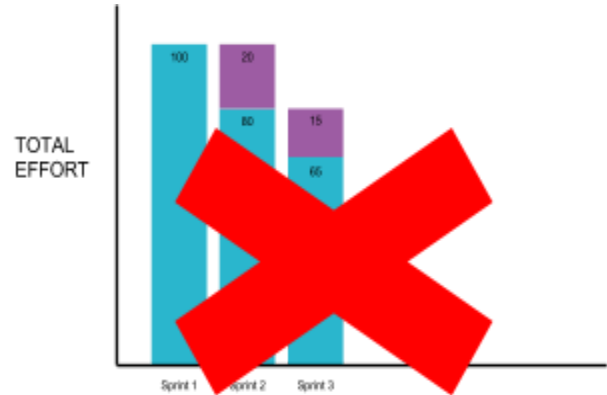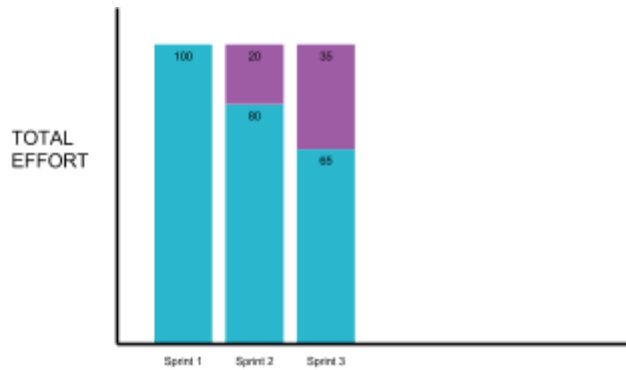
Now, let's say that 10 story points of work are removed from the project at the end of Sprint 3, and that the development team completed 20 story points in Sprint 3. We now need to show a change in story points. This is easy to do. We add up our numbers for our bars the same way that we have been doing. At the beginning of Sprint 3, we had 65 story points remaining. We then removed 10 story points, so we now have 55 story points remaining. We also completed 20 story points, so we now have 35 story points remaining. As for work completed, we had 35 story points completed at the beginning of Sprint 3, and we completed 20 story points of work in Sprint 3, therefore we have completed 55 story points so far in the project. Our burndown chart will now look like this:
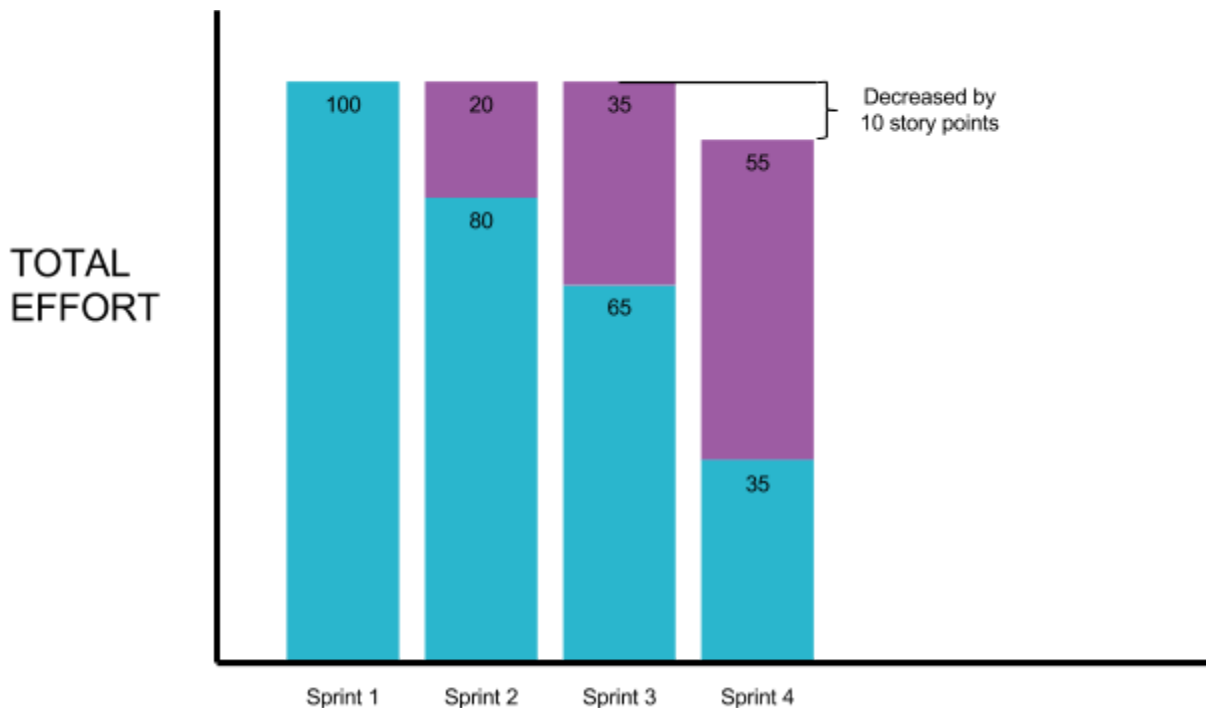
You'll notice that our Sprint 4 bar is now 10 story points shorter than our Sprint 3 bar. This is because we removed 10 story points. You can see in a quick glance, that there was a change in story points.

Now, I'm sure you can guess what happens when we add new story points to a project, but let's look at it in our example. Let's say that in Sprint 4, 15 story points were added, and 10 story points were completed.

Let's start by calculating our height for the work remaining portion of the bar. At the beginning of Sprint 4, we had 35 story points remaining. We then added 15 story points, which gives us 50 story points remaining. We also completed 10 story points, so that gives us 40 story points remaining. To calculate our work completed, we add our 10 story points completed, to our 55 total story points completed, which makes our new total story points completed equal to 65 story points. Our burndown chart now looks like this:
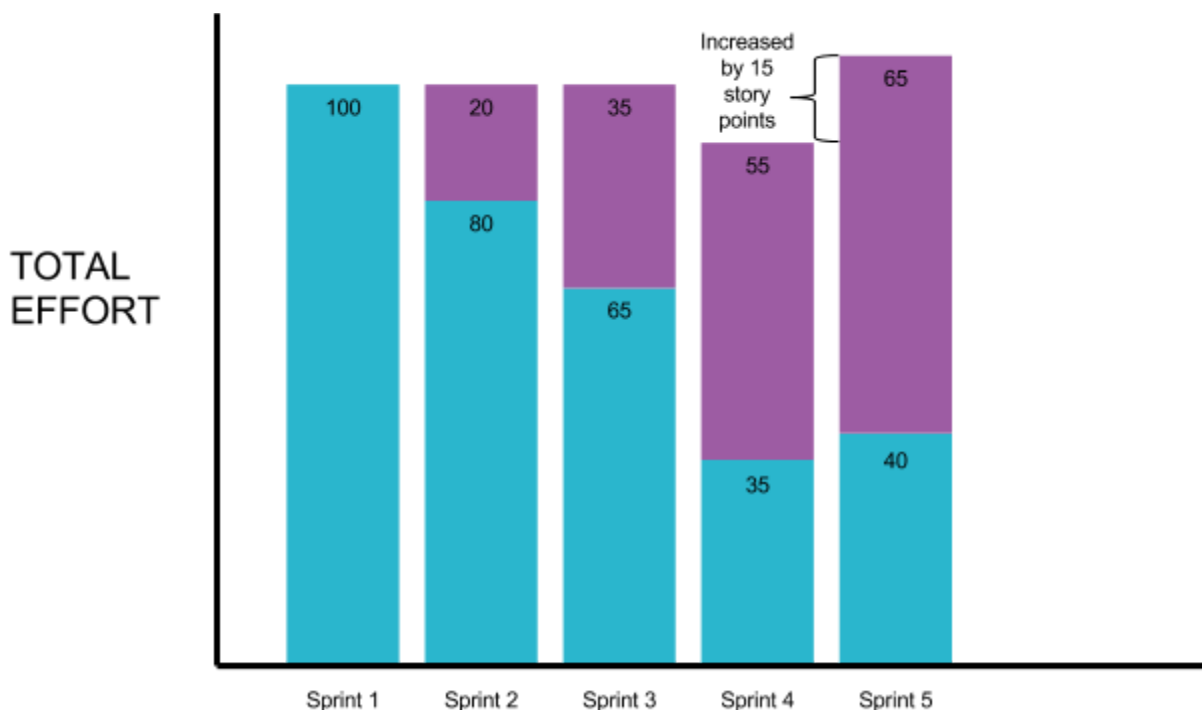
To finish off our example, let's say that in the fifth sprint the team removed 20 story points and also completed 20 story points. This means that our work remaining portion of the bar for Sprint 6 is now 0 (since 40-20-20=0), and our work completed bar is now 85 (since 65+20=85). Our burndown chart would now look like this:
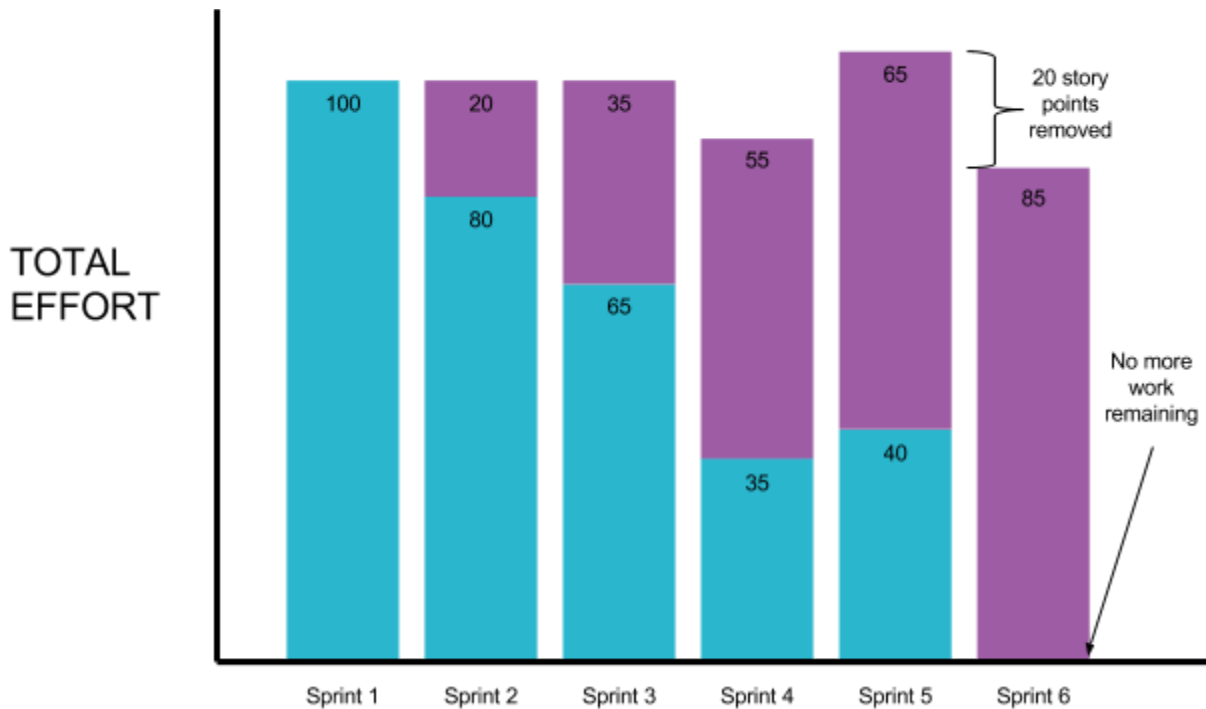
Since there is no more work remaining, that means our development team completed the project! They were able to complete the project in 5 sprints.

But wait! If they completed the project in 5 sprints, why do we have 6 sprints on our burndown chart?

Well, this is because the bars represent the project at the beginning of each sprint. If there was no work to do at the beginning of the sixth sprint, that means that the team completed it all in 5 sprints.

Now, all we are missing a prediction line! There are two ways to create and use a prediction line. The first is to show how many sprints the project will take you if you are maintaining some velocity. Let's say our goal was to maintain the velocity of 10 story points per sprint.

We also have to adjust the height of the prediction line to the _**most current**_ height. In this case, our Sprint 6 bar is the most current sprint, so we use the height of that bar (i.e. 85 points) as the height of our prediction line.

Our burndown chart with a prediction line would look like this:
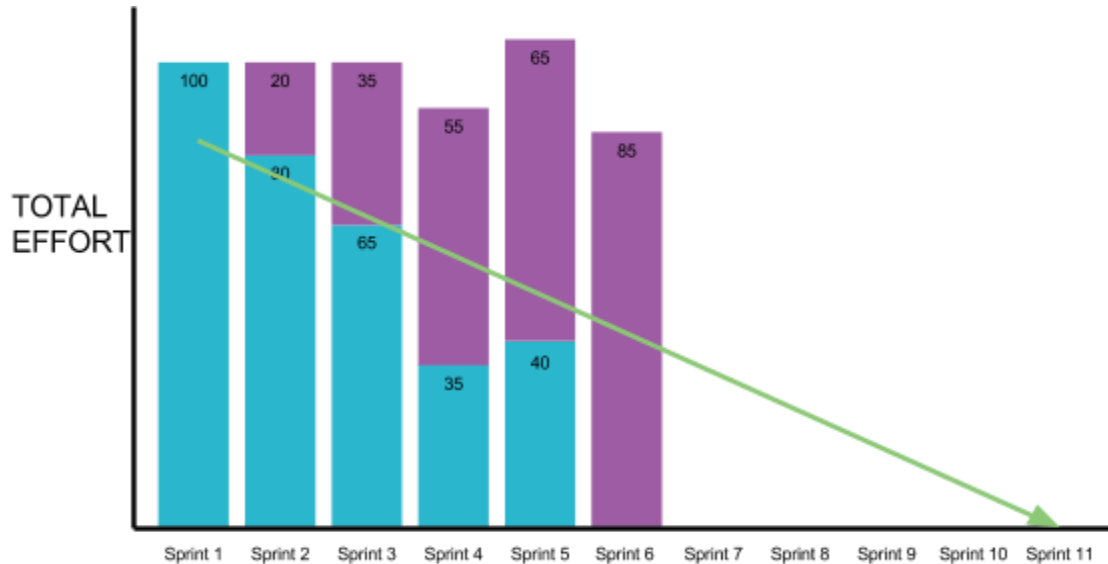
If we started with 100 story points and completed 10 story points each sprint, it would take 10 sprints to complete the project, so that means our prediction line points to the eleventh sprint. Again, this is because there would be no work left to be completed at the beginning of Sprint 11, so that means it took 10 sprints to complete it all.

The other way to use the prediction line, is to determine an ideal velocity that should be maintained if you wanted to complete the project in a certain amount of sprints.

For example, say we were aiming to complete the project in 5 sprints. Our prediction line would look like this:
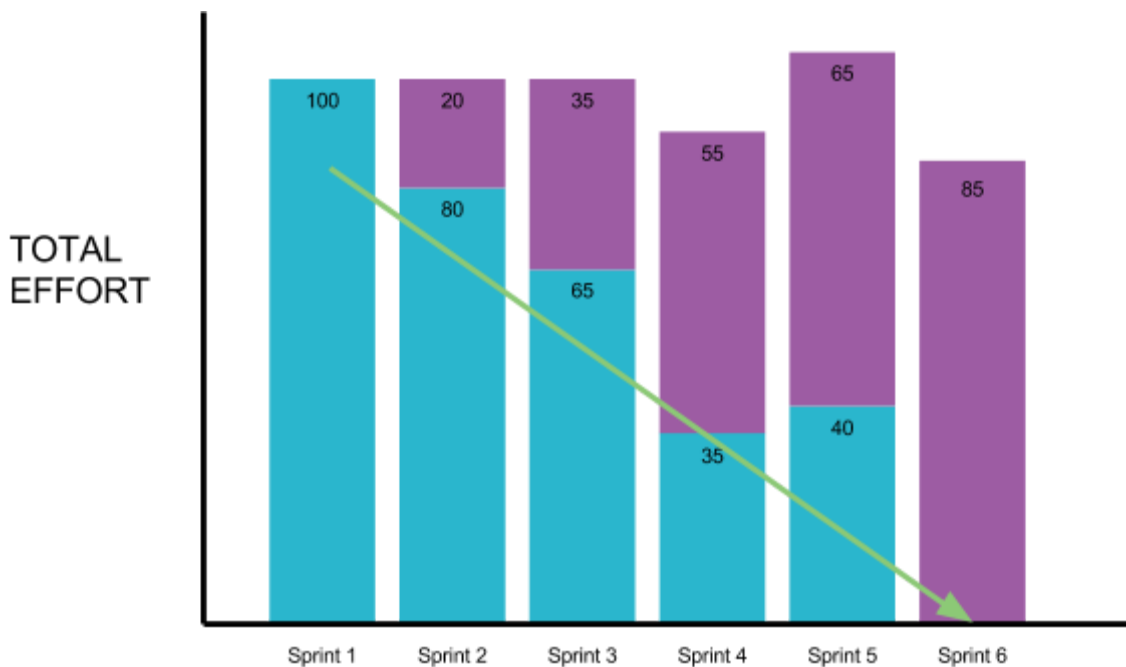
It points to a sixth sprint, which indicates that the project will be completed in 5 sprints. The prediction line now shows you a constant velocity that you would want to maintain if you wanted to complete the project in 5 sprints.

Again, note that the prediction line height is adjusted to the height of the most current sprint.

This prediction line shows us that at the beginning of Sprint 2, we were on target with our ideal velocity, but then fell behind schedule at the beginning of Sprint 3. We see this because the blue bar is above the prediction line. At the beginning of Sprint 4 we got ahead of schedule, and at the beginning of Sprint 5 we fell behind schedule again. We ended up catching up to the prediction line during the fifth sprint, since our Sprint 6 prediction line points to 0.
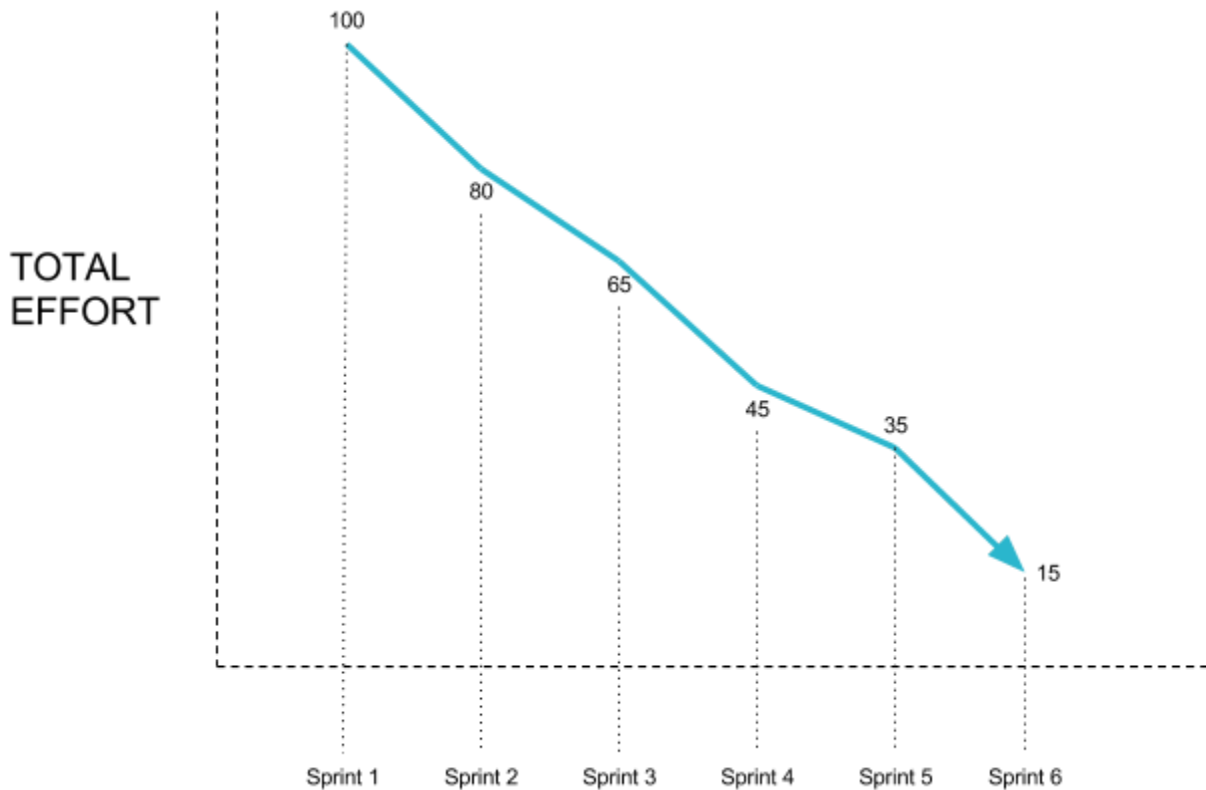
HINT: This is the type of prediction line that you will use in the Capstone project.

Now, let's quickly look at how to make an **adjustable floor burndown chart**. You have a choice as to which type of burndown you use. Both display the same information, so it is just a matter of preference.

To create the work remaining part of the graph (which was represented in blue before), you are just concerned with the values of the work completed each sprint. To recap from the example above, here are the values for the project:

	Story Points Completed	**Change in # of Story Points**
Sprint 1	20	0
Sprint 2	15	0
Sprint 3	20	-10
Sprint 4	10	+15
Sprint 5	20	-20

This is what the burndown would look like if we were not concerned with the change in story points:

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TOTAL EFFORT

100
80
65
45
35
15

Sprint 1   Sprint 2   Sprint 3   Sprint 4   Sprint 5   Sprint 6

To create the adjustable floor, we show the change in story points along the horizontal axis. If story points are removed, then we move the adjustable floor above the horizontal axis, if story points are added, the adjustable floor drops below the horizontal axis.

Here is what the burndown looks like with an adjustable floor:
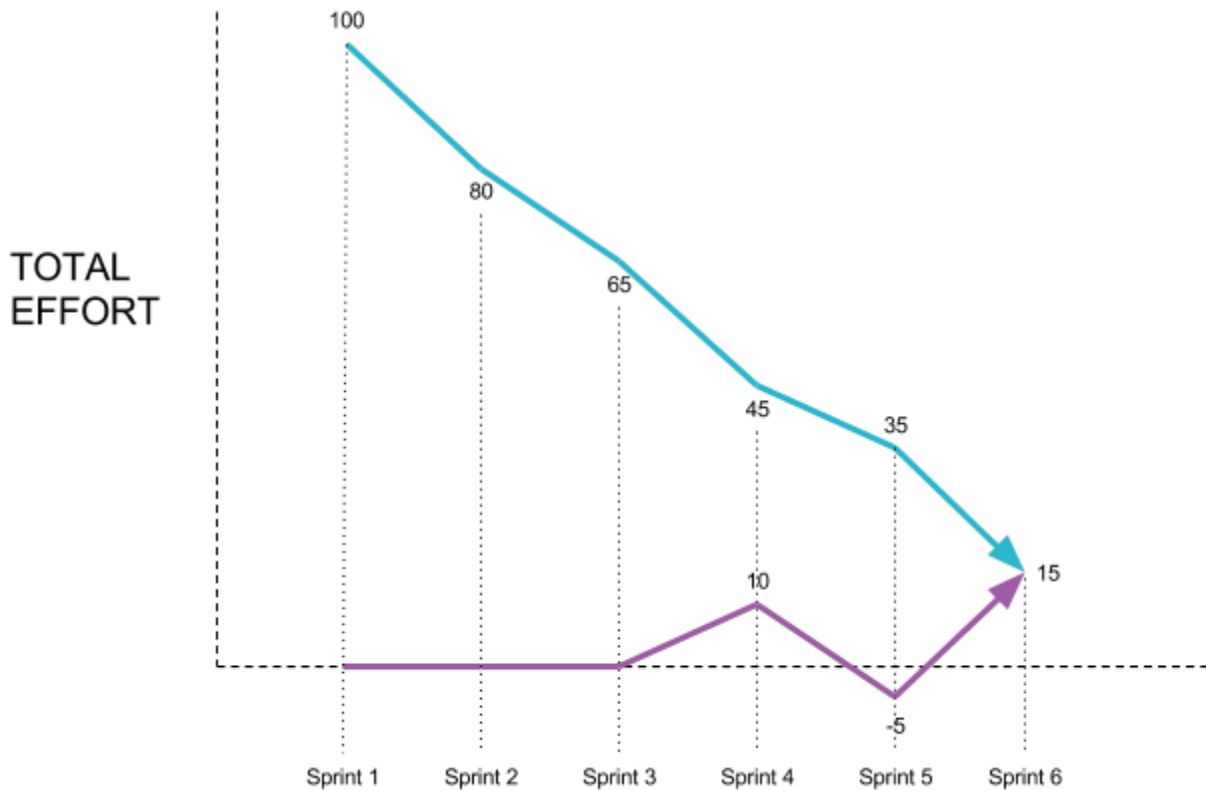
Now we need a prediction line. Instead of adjusting the height of the prediction line, with an adjustable floor burndown, we bring the prediction line to meet the adjustable floor. It would look like this:
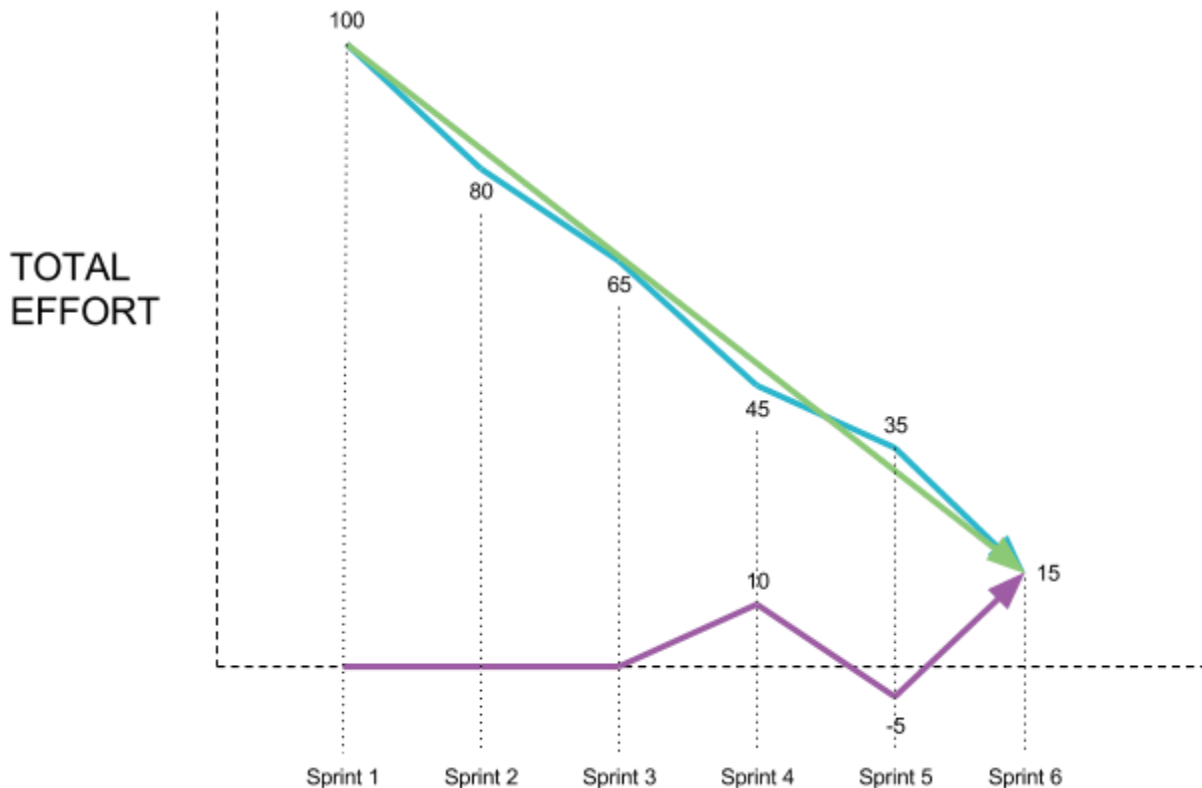
If you subtract the height of the adjustable floor from the height of the burndown, you get the amount of work remaining. So for Sprints 1-3 the height of the floor is 0, so the work remaining is equal to the height of the burndown. For Sprint 4, the height of the burndown is 45 and the height of the adjustable floor is 10, therefore the amount of work remaining is 35 story points. In Sprint 5, the height of the burndown is 35, and the height of the adjustable floor is -5 so there is 40 story points of work remaining (watch those negatives!). Then in Sprint 6, we have the height of the burndown equal to 15 and the height of the adjustable floor equal to 15, so that means that there is 0 work remaining, so that project was completed in 5 sprints.